# Water Quality and Conveyance Excerpts

# Proposed changes to the Revised Phase II Report

**November 30, 1998**

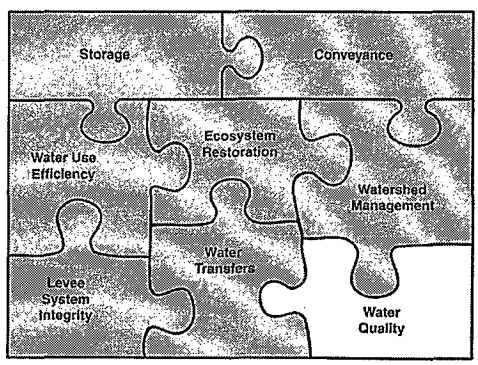
CALFED
BAY-DELTA
PROGRAM

1. Include the exterior levees (approximately 230 miles) into CALFED's Levee Program. The existing "Suisun Marsh Exterior Levee Standard" would be adopted.
2. Reconfigure the Marsh to protect existing managed wetlands and develop new tidal wetlands. Some landowners have expressed opposition to this alternative because it would affect their current land use.

In 1999, CALFED staff will further develop these two options by completing the following tasks:

- Get additional stakeholder (including local landowners) input
- Develop various Marsh configurations to study
- Quantify benefits
- Perform two-dimensional system modeling on various Marsh configurations to determine how they affect water quality in the marsh and in the Delta
- Quantify Ecosystem Restoration Plan linkages
- Develop feasibility level cost estimates
- Document results in the Long-Term Levee Protection Plan (The potential impacts of including the Suisun Marsh levee system into the Levee Program are documented in the Draft Programmatic EIS/EIR)
- Develop alternative funding sources

## Water Quality Program




CALFED is committed to achieving continuous improvement in the quality of waters of the San Francisco Bay-Delta estuary until no ecological, drinking water, or other beneficial uses of the waters are impaired by water quality problems, and to maintaining this quality once achieved. This objective extends to the watersheds of the estuary to the extent that water quality problems in these watersheds affect beneficial uses dependent on the estuary. "Continuous" as used here means a steady or step-wise trend over the 30-year time horizon of the CALFED Program, and does not include short-term fluctuations that may be brought about by wet or dry hydrologic conditions, or other shorter term, temporary, events. Although specific water quality targets have been established to gauge the success of the Water Quality Program, CALFED commits to seeking the best water quality, going beyond these targets where feasible and cost effective.

The Water Quality Program contains numerous actions directed at improving the quality of water to support ecological resources and to protect CALFED investments in ecosystem restoration projects. Other program actions are directed at improving the quality of Delta waters to support agricultural and recreational uses of the resource. Drinking water supply is another important beneficial use of Delta waters, as the Delta is a source of drinking water to about two-thirds of the State's population. Drinking water elements of the Water Quality Program are emphasized in this section because, unlike other water quality aspects, drinking water issues have great significance to the selection of a Preferred Alternative.

## Water Quality Targets

For many water quality parameters, numerical and/or narrative objectives for the protection of ecological and other beneficial uses already exist in water quality control plans adopted by the State and Regional Water Quality Control Boards. The CALFED Water Quality Program has adopted regulatory objectives where appropriate as its targets for water quality improvement, such as for selenium and mercury. For some water quality parameters, objectives do not presently exist. This is particularly true for drinking water that receives further treatment prior to use (see page 42). As the Water Quality Program evolves, it is anticipated that periodic re-evaluation of water quality targets will be one feature of adaptive management as applied to this program.

With respect to drinking water beneficial uses, the CALFED objective is to continuously improve source water quality that allows for municipal water suppliers to deliver safe, reliable, and affordable drinking water that reliably meets, and where feasible, exceeds applicable drinking water standards. CALFED program actions will be aimed at reducing the levels of bromide, organic carbon, and pathogens in Delta drinking water sources. CALFED's target for providing safe, reliable, and affordable drinking water is to achieve either:

a) monthly average concentrations at Clifton Court Forebay of 50 ug/L bromide and 3 mg/L organic carbon; or

b) an equivalent level of public health protection utilizing a cost effective combination of alternative source waters, source control, and/or treatment technologies.

Enabling Delta water users to substitute higher quality source water for Delta water offers important opportunities to provide safe drinking water, and will be intensively investigated within the CALFED Program. However, because source water substitution is probably not feasible for all drinking water supplies from the Delta, the importance of developing adequate source water quality in the Delta cannot be ignored.

In seeking to meet its commitment to provide urban agencies with water sufficient in quality to produce safe and affordable drinking water that meets and, where possible, exceeds standards for

public health protection, CALFED will consider additional water management options including, but not limited to, an isolated facility to provide source water of better quality. The degree of improvement needed, if any, will be determined based on developments in treatment technologies, future regulatory directions and results of new health effects studies. CALFED plans an active role in fostering development of the information that will make such determinations possible.

An important feature of drinking water supplies taken from the Delta is higher bromide concentrations than are found in the drinking water supplies of about 90% of the nation. Bromide (a salt) reacts with disinfection chemicals to form harmful chemical byproducts that have increasingly raised health concerns for consumers. Most of this bromide comes from the ocean as a result of its connection with the Sacramento-San Joaquin Bay-Delta estuary, and can most effectively be controlled by limiting the mixing of fresh Delta water and saline ocean water.

Therefore, unlike most of the other water quality parameters of concern to CALFED, the choice of CALFED conveyance options can profoundly influence concentrations of bromide and other salts in Delta waters. The bromide question is, therefore, inseparably linked to conveyance within the CALFED program. See **Conveyance**, p. 62.

**Program Actions**

The Water Quality Program has relied on the technical expertise of a variety of stakeholders to define approaches to solving water quality problems, and to develop programmatic actions to meet CALFED objectives. While some actions are sufficiently developed for early implementation, others rely on comprehensive monitoring, pilot studies, and research to improve our understanding of effective water quality management and to influence future actions to control water quality problems at their sources. This approach allows actions to be taken on known water quality problems and sources of those problems, while allowing further monitoring, research, and testing of potential problems and solutions. Actions will be adapted over time to ensure the most effective use of resources.

In summary, the Water Quality Program component includes the following broad categories of programmatic actions:

- **Drinking Water Parameters** - ~~Increase source water quality and treatment technology to reduce potentially toxic and carcinogenic disinfection by-products by controlling~~ total organic carbon (TOC), pathogens ~~(controlling inputs from rangelands, dairies, and confined animal facilities),~~ turbidity, ~~and~~ bromides. ~~The~~ quality of drinking water supplies taken from the Delta will be improved through source reduction measures. Improve source water quality and utilize treatment technology to reduce potentially toxic and carcinogenic disinfection by-products by controlling pathogens and nutrients from urban sources and total organic

carbon (TOC); pathogens (from rangelands, dairies, and confined animal facilities) and salinity from agricultural sources; turbidity and bromides.

- **Pesticides -** Reduce impacts of pesticides (including diazinon and chlorpyrifos) through development and implementation of Best Management Practices, for both urban and agricultural uses, and support of pesticide studies for regulatory agencies while providing education and assistance in implementation of control strategies for the regulated pesticide users.

- **Organochlorine Pesticides -** Reduce the load of organochlorine pesticides in the system, including residual DDT and chlordane, by reducing runoff and erosion from agricultural lands through Best Management Practices. Sediment control will also protect valuable topsoil and prevent costly maintenance of drainage systems.

- **Trace Metals** - Reduce impacts of trace metals such as copper, cadmium, and zinc in upper watershed areas, near abandoned mine sites. Reduce impacts of copper through urban stormwater programs and agricultural Best Management Practices. Study the ecological impacts of copper in the Delta. Determine the feasibility of copper reduction.

- **Mercury** - ~~Reduce mercury in rivers and the estuary by source control at inactive and abandoned mine sites. Also, study bioavailable mercury in the rivers and the estuary and its potential threat to human health.~~ Reduce mercury in rivers and the estuary by source control at inactive and abandoned mine sites. Determine current mercury levels in water, sediment and fish in the estuary, rivers and affected tributaries. Implement comprehensive monitoring and research program to determine loadings and sources of total and methyl mercury, transport of mercury in

**Further research is needed for some water quality problems.**

~~For example, for some parameters of concern, such as mercury, not enough is understood about its sources, the bioavailability of mercury to various species, factors contributing to its bioavailability, and the load reductions needed to reduce fish tissue concentrations necessary for human consumption.~~ For example, as to mercury, not enough is understood about the relative contribution of various mercury sources; factors affecting the transformation of mercury from one form into another (particularly the formation of methyl mercury, the most bioavailable form); specific control measures that will reduce the levels of bioavailable mercury within the estuary; and, ultimately, the level of load reductions needed to reduce fish tissue concentrations to levels that will render the fish safe for human consumption. In addition, research is needed to determine what effect wetlands restoration activities will have on the bioavailability of mercury in soils in these restoration areas.

sediment, factors affecting mercury transformation and bioaccumulation in the estuary, and concentrations of mercury in indicator species. Use this information to prioritize remendation or cleanup of mercury sources.

- **Salinity** - ~~Reduce salinity through reduction of leaching of agricultural land via irrigation improvement, crop selection and changes in land use. Reduce imports of salt and study non-agricultural source contributions. Salinity reductions in the San Joaquin River would also incorporate real-time management of salt discharges. San Joaquin drainage problems have been evaluated in several studies over the past two decades. Complete resolution of the San Joaquin drainage problems is beyond the scope of the CALFED Bay-Delta Program.~~ Reduce salinity through reduction of leaching of agricultural land via irrigation improvement, crop selection and changes in land use. Reduce imports of salt and determine non-agriculatural source contributions. Salinity management in the San Joaquin River would also incorporate real-time management of salt discharges to time discharges during periods of high river flow. Complete resolution of all of the San Joaquin drainage problems is beyond the scope of the CALFED Bay-Delta Program.

- **Selenium** - Reduce selenium, through irrigation control, crop selection, and possibly land fallowing or land retirement. ~~Impacts of selenium will be further reduced by real-time management of selenium-laden agricultural drain water released to the San Joaquin River to minimize concentrations in the river when selenium discharges occur.~~ In addition, CALFED will consider opportunities to manage the remaining selenium-laden drainage to minimize the impacts of its discharge to the San Joaquin River and Delta.

- **Turbidity and Sedimentation** - Reduce turbidity and sedimentation which affect several hydraulic areas in the Bay Delta and its tributaries. Study ecological impacts of sedimentation. Control sedimentation in several watersheds to protect spawning beds and maintain capacity of streams.

- **Low Dissolved Oxygen** - Reduce impairment of rivers and the estuary caused by substances that exert excessive demand on dissolved oxygen. Oxygen depleting substances are found in waste discharges, agricultural discharges, urban stormwater, sediment, and algae.

- **Toxicity of Unknown Origin** - Through research and monitoring, identify parameters of concern in the water and sediment within the Delta, Bay, Sacramento River and San Joaquin River regions and implement actions to reduce their toxicity to aquatic organisms.

## Bromide and Organic Carbon Management

**Water Quality Program Facts and Figures**

- Provides critically needed reduction of toxics for fisheries and an important reduction in organic carbon to improve drinking water.
- Does not completely address health concerns associated with bromide without other Program elements.
- Could exceed $0.75 billion over 20-30 years. May require annual investment exceeding $30 million.

An analysis (currently under peer review) of bromide and organic carbon sources in Delta drinking water supplies was undertaken to develop a realistic expectation of what level of reductions in bromide and organic carbon concentrations might be expected as a result of Water Quality Program actions. This analysis indicates that the Pacific Ocean and the San Joaquin River are the most important sources of bromide in Delta waters. Further analysis of the San Joaquin River indicated that about 80% of the bromide found there can be accounted for by bromide entering the Delta through the Central Valley Project pumps at Tracy. Evidence suggests that other sources of bromide, such as pesticide use in the Valley or natural sources in San Luis Reservoir are not as important; therefore, it appears that a large majority of bromide found in the San Joaquin River is from recirculated Delta water containing bromide from the ocean. This bromide analysis indicates that, because bromide in Delta drinking water supplies comes mostly from the ocean, it is probably not possible for water quality actions to reduce bromide concentrations by more than 20% at best.

Water flowing through the Delta to municipal water intakes picks up organic carbon. Studies have demonstrated that a majority of this added carbon comes from drainage off Delta islands. Organic carbon, unlike bromide, is subject to removal, at least to some extent, through conventional water treatment processes. While a number of practical problems would affect the feasibility and economics of reducing organic carbon to acceptable levels, it appears to be theoretically feasible to meet this objective through water quality program actions involving land and water management and treatment either on Delta islands or at treatment plants. Further studies will be required to more fully quantify the results of potential water quality actions, and to establish the feasibility of implementing these actions.

## Relation to Other Program Elements

Other components of the CALFED Program can affect water quality. Storage can help in the management of flows and water quality after source control efforts. As previously discussed, improved conveyance to south Delta export pumps can substantially improve water quality for those diversions. However, such changes have the potential to decrease quality of in-Delta diversions. Water use efficiency measures can improve water quality entering the Delta by reducing some agricultural and non-agricultural discharges containing pollutants. Wastewater

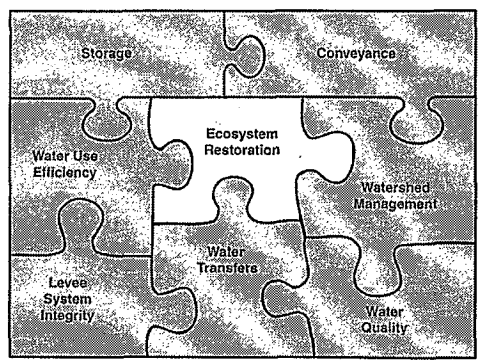
reuse depends on high quality water to prevent salt damage of irrigated land or corrosion of industrial equipment.

In the event of a catastrophic levee failure in the Delta, the amount of saline water entering the system could be such as to make Delta waters unusable for many months. Besides making the water unusable for agricultural, industrial, or domestic purposes, it could also destroy delicate ecosystem balances and ruin CALFED investments in ecosystem restoration. Therefore, it is difficult to overestimate the importance of a successful Delta levee program to achieving and maintaining good water quality for the beneficial uses of Delta waters.

The CALFED Comprehensive Monitoring, Assessment, and Research Program (CMARP) will be the primary vehicle for measuring the extent to which continuous water quality improvement is achieved. Performance will be measured by comparing ambient water quality (where appropriate) to specific water quality objectives that have been established for the parameters of concern.

More information on the water quality program will be included in the revised *Water Quality Program Plan.*

## Ecosystem Restoration Program

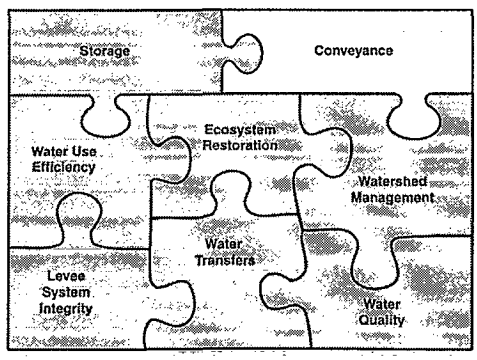



The Ecosystem Restoration Program (ERP) is the principal mechanism that CALFED will use to restore the health of the Bay-Delta ecosystem. The overarching goal of the ERP is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. The ERP is composed of three volumes: Volume I contains vision statements that describe the ecological attributes and desired future Bay-Delta conditions; Volume II outlines over 700 programmatic restoration actions for the 14 ecological management zones delineated within the Bay-Delta ecosystem; and the Strategic Plan describes the ecosystem-based, adaptive management approach that will be used to implement the restoration program.

The ERP is predicated upon an ecosystem-based management approach that emphasizes the restoration of ecological processes. By restoring the natural processes that create and maintain diverse and vital habitats, the ERP aims to meet the needs of multiple plant and animal species while reducing the amount of human intervention required to maintain habitats. Through this ecosystem-based approach, the ERP will contribute to or assist in the recovery of endangered and threatened species that use the Bay-Delta, and it will help improve the population abundance and

# Conveyance

## Introduction




The Delta conveyance element of the Program describes the various configurations of Delta channels for moving water through the Delta and to the major export facilities in the southern Delta. While there are countless combinations of potential modifications to Delta channels, three primary categories of Delta configuration options, as described below, were studied in Phase II of the Program. These Delta conveyance options were the primary distinguishing features among the three broad categories of alternatives studied in Phase II.

Because of the potential impact on flow patterns and Delta water quality, the Delta conveyance configuration of an alternative can greatly affect the performance of other Bay-Delta program elements. The three primary Delta conveyance configurations evaluated in Phase II of the program are:

**Existing System Conveyance**. The Delta channels would be maintained essentially in their current configuration. One significant variation would include some selected channel improvements in the southern Delta together with flow and stage barriers at selected locations to allow for increasing the permitted pumping rate at the SWP export facility to full existing physical capacity of 10,300 cfs. These physical changes in the existing system include many of the features contained in the proposed Interim South Delta Project. Other variations that address the same needs are also being evaluated.

**Modified Through Delta Conveyance**. Significant improvements to northern Delta channels would accompany the southern Delta improvements contemplated under the existing system conveyance alternative. Variations include a wide variety of channel configurations, designed to improve flow patterns to benefit fisheries throughout the Delta, provide flood control, and improve water quality in many parts of the Delta.

**Dual Delta Conveyance**. The dual Delta conveyance alternative is formed around a combination of modified Delta channels and a new canal or pipeline connecting the Sacramento River in the northern Delta to the SWP and CVP export facilities in the southern Delta. Capacities for this new isolated conveyance facility in the range of 5,000 cfs to 15,000 cfs were evaluated in Phase II of the Program. The new facility would siphon under all major waterways to minimize aquatic impacts.

~~Not all of the Delta waterways follow natural channels. Some were constructed for navigation~~

~~which is an important Delta function. In addition to periodic navigational work on many Delta waterways, the U.S. Army Corps of Engineers built and maintains two commercial shipping channels through the Delta. The ports of Stockton and Sacramento are served by the Stockton Deep Water Ship Channel, completed in 1933, and the Sacramento Deep Water Ship Channel, completed in 1963. Most of the length of these channels have since been deepened to 35 feet. It is possible that changes in flow patterns may result in changed operation and maintenance requirements of the channels.~~

**Strategy**

The CALFED strategy regarding conveyance must consider water quality for in-Delta uses, drinking water quality, and fisheries. These factors are critical to conveyance decisions both now and in the future as part of adaptive management. The existing Delta channels will be an integral part of any CALFED decision for Delta conveyance. The reliance on these channels provides a shared interest in restoring, maintaining, and protecting Delta resources, including water supplies, water quality, levees, natural habitat, and the common Delta Pool, which also protects in-Delta agricultural uses. Some modifications to these through Delta channels can improve all of these Delta resources. Regardless of choices that may be made in the future, it makes sense to invest in these modifications to maximize chances that CALFED can meet the Program's purpose.

**CALFED's basic strategy is to develop a through Delta conveyance alternative based on the existing Delta configuration with some modifications.** This strategy focuses on making the through Delta conveyance achieve CALFED purposes. Details of conveyance improvements will undergo subsequent environmental analysis, but are expected to be similar to the following:

- South Delta channels would remain in their existing configuration except that Old River would be enlarged in the reach north of Clifton Court to reduce channel velocities and associated scouring.

- A new 2,500 cfs at 0.2 fps through-screen velocity (5,000 cfs at 0.4 fps through-screen velocity) fish screen would be constructed for the Tracy Pumping Plant.

- A new 6,000 cfs at 0.2 fps through-screen velocity (12,000 cfs at 0.4 fps through-screen velocity) screened intake with low lift pumps would be constructed at the head of Clifton Court and the SWP and CVP would be connected to aid flexible operations.

- An operable fish control barrier would be constructed at the head of Old River. Operable flow control barriers or their equivalent would be constructed in south Delta channels to alleviate the problem with reduced water levels and water

quality problems that would be caused by the fish control barrier and export operations.

- A new Hood diversion test facility (with fish ladder or equivalent for upstream migrating fish) on the Sacramento River capable of diverting up to 2,000 cfs from the Sacramento River to the Mokelumne River would be constructed.

- North Delta channels along the Mokelumne River from Interstate 5 to the San Joaquin River would be enlarged by setback levees and dredging.

In addition, the initial CALFED Program will include:

- San Joaquin River and Delta water quality improvement actions described in the Stage 1 action list and in more detail in the Water Quality Program Plan would be implemented.

- Source control measures for drinking water quality, including aqueduct watershed management measures, as described in the Stage 1 action list and in more detail in the Water Quality Program Plan would be implemented.

- Ecosystem Restoration measures for fishery improvement as described in the Stage 1 action list and in more detail in the Ecosystem Restoration Program Plan (including DEFT actions) would be implemented.

Modifications to the through Delta conveyance strategy will be made only after thorough assessment of a variety of factors. For example, a decision to construct an isolated facility will be warranted if, after aggressive implementation of relevant common program elements and improvements to through Delta conveyance, there is still a public health necessity for improved drinking water at the source (e.g., bromide levels). This would arise ~~arising~~ from technical or economic infeasibility of providing safe drinking water through other methods (i.e., inability to achieve a level of public health protection in drinking water through alternate means equivalent to Delta source water quality of 50 parts per billion bromide; see page 42). ~~and/or~~Such a decision would also be warranted if there is inability to achieve fishery recovery ~~with~~due to continuing impacts of diversions from the south Delta. A combination of these two factors could also result in a decision for an isolated facility and/or other additional actions to meet CALFED goals. These factors will be continually reevaluated during Stage 1 as part of the adaptive management process, and will form the basis for a comprehensive set of additional improvements in Stage 2. Such reevaluation could be assisted by panels of recognized technical experts that would consider all of the relevant information and, in conjunction with stakeholder input, make recommendations to the appropriate decision making body.

To provide for the best adaptive management decision making in the future, aggressive monitoring and research, as well as thorough development and evaluation of alternatives must occur. For drinking water quality issues this means Stage 1 must include the following (see pages 75-76):

1. Performance of public health effects studies to more specifically identify the potential health effects of bromide related disinfection byproducts.

2. Investigation of alternative sources of high quality water supply for municipal users of Delta water.

3. Investigation of advanced treatment technologies for the removal of salt, bromide, total organic carbon, and pathogens in municipal water supplies.

4. Investigation of combinations of new supplies and technologies that can minimize salt content of municipal water supplies and provide greater public health protection.

For fishery issues, Stage 1 must include adequate monitoring and research to answer the following questions (see page 88):

- What measures have been taken to restore fisheries?
- How adequate are the measures?
- How are the actions affecting target species, and are there any unexpected adverse effects on other species?

If a decision to build an isolated facility ~~were~~is ultimately made, it would be coupled with <u>each</u> of the following assurances:

1. An agreement limiting the amount of water that can be exported (linked to water year types and flexible enough to allow additional exports when conditions allow).
2. Commitment to preserve in-Delta water quality sufficient to protect existing beneficial uses (Delta standards or contracts including assurances for implementation, permits, financing, and O&M).
3. Commitment to address potential seepage and flood impacts of an isolated facility along its alignment.
4. Long-term funding for Delta levees (perhaps tied to quantity of water moved in the isolated facility or other institutional assurances) and commitment to provide at cost, suitable excess excavated material from facility construction for levee and habitat improvements.
5. Reaffirm commitment to protect all area of origin water rights.

6. Completion of all environmental documentation and permitting requirements.
7. Demonstrated commitment to finance by beneficiaries.
8. Agreement on operating authority and operating criteria.